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TECHNICAL EVALUATION REPORT ON THE AVIONICS PANEL/GUIDANCE AND --ETC(U)
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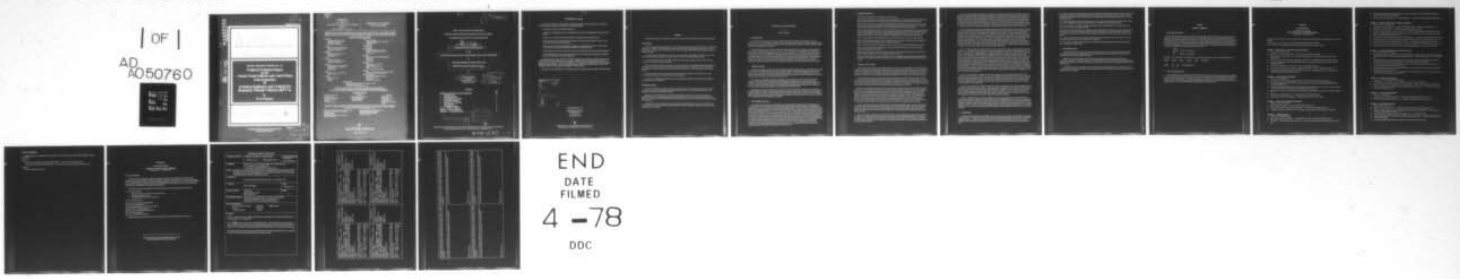

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AGARD ADVISORY REPORT No. 113

Technical Evaluation Report on the Avionics Panel/Guidance and Control Panel Joint Symposium on Avionics/Guidance and Control for Remotely Piloted Vehicles (RPV's)

by

M.A.Ostgaard

NORTH ATLANTIC TREATY ORGANIZATION

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ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT

(ORGANISATION DU TRAITE DE L'ATLANTIQUE NORD)

AGARD Advisory Report No.113

TECHNICAL EVALUATION REPORT

on the

AVIONICS PANEL/GUIDANCE AND CONTROL PANEL JOINT SYMPOSIUM

on

AVIONICS/GUIDANCE AND CONTROL FOR REMOTELY PILOTED VEHICLES (RPV's)

by

Morris A. Ostgaard
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OH 45433, USA

Dec 77

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Technical Evaluation Report of the Avionics Panel/Guidance and Control Panel Joint Symposium held at Scuola di Guerra Aerea, Florence, Italy 3–6 October 1976.

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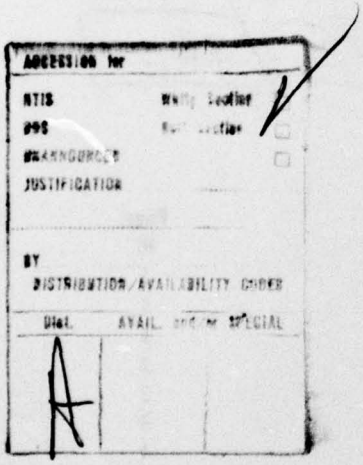

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SUMMARY

The following summarizes the significant conclusions and recommendations resulting from the Technical Evaluation.

CONCLUSIONS

The lack of specific requirements appears to be the one area that impedes development of RPV Systems. Without this requirement it is difficult to focus and structure a system to fulfill a need and stimulate innovative concepts. There is a thought that even perhaps a multi-role RPV using active control technology could provide mission flexibility at lower cost than present designs.

An innovative approach to launch and recovery may be one of the keys to development of the RPV system. At the present these operational and support costs appear to deter or limit RPVs to highly specialized missions.

A new and innovative approach to functional integration to make maximum usage of on-board sensors is the key element to a cost effective development of RPVs.

The role of the human operator is not well known, and is still the subject of considerable discussion although data to date indicate that his role is probably most useful in a monitor and guidance role rather than a vehicle control role for several reasons, one being the data link band width requirements and secondly the work load imposed on ground based operator.

The area of command and control and secure data link seem the most ill defined areas of RPV control. These concepts directly impact force structure and mixed force considerations.

The lack of low visibility target identification and acquisition sensing capability appear dominant in determining system requirements and applications.

RECOMMENDATIONS

It appears that a NATO or AGARD or possibly an AGARD support of a NATO study group to determine critical technology areas of RPVs and potential designs that will permit these systems to be integrated effectively into force structure in a NATO environment should be formed.

Integrated control techniques that are currently being investigated for advanced manned aircraft should be investigated to determine if, through the application of techniques such as active control technology and functional integration there could result in a multi-role RPV system that could overcome some of the cost and design limitations exposed in this conference.

A study be performed to determine if alternate techniques, other than emulation of visual (i.e., FLIR, LLTV, etc.) can developed to provide a low visibility operational capability. Precision positioning in a grid network with target state estimation may be a candidate.

TECHNICAL EVALUATION REPORT

by

Morris A.Ostgaard

1. INTRODUCTION

The AVP/GCP Joint Symposium on Avionics/Guidance and Control for RPVs was held in Florence, Italy 3–6 October 1976. The Co-chairmen for this meeting were Mr. J.T.Freedman, and Professor C.T.Leondes. The program as presented at this symposium is appended to this report. The complete compilation of papers have been published as AGARD Conference Proceedings CP.213 (Classified.)

This joint symposium was an outgrowth of an earlier specialist meeting held by the Guidance and Control Panel on Remotely Piloted Reusable Vehicles, in Paris, France on 17 and 18 October 1974. This specialist meeting highlighted certain problems and issues that suggested a more detailed review and exposure to the NATO Community. As a result of this specialist meeting it was decided that a symposium be organized and structured to define needs, requirements and technologies required to provide an RPV military capability. Since this earlier meeting identified predominately guidance and control and avionics issues this symposium was structured to jointly address these specific issues. This report represents the best attempt by the evaluator to filter the symposia presentations, discussions, and comments, assess technology trends and state-of-the-art, in order to identify the critical issues, as well as establish a conference consensus.

2. SYMPOSIUM THEME

There is a growing military interest in the Remotely Piloted Vehicle to augment or replace a manned aircraft. In some typical applications the RPV might serve as a sensor to perform the roles of the forward air controller, spotter, forward observer or the reconnaissance patrol. Other sensor applications might be to extend the capabilities of radar, electro-optical or acoustical systems. The RPV might also provide an attractive alternative to the use of strike aircraft or stand-off weapon delivery or as a platform for counter measures operations.

The challenge to the Avionics designer and the guidance and control designer is then to develop truly effective systems for unmanned operation with minimized data transmission requirements and a maximum of autonomous capability. The corollary needs for effective on-board processing, jam resistant data and command links, navigation and control are apparent. These objectives must be accomplished within the framework of overall systems constraints and hence place great emphasis on light weight, low-cost integrated system implementations.

It is therefore opportune to examine the state-of-the-art in the field of avionics and guidance and control related to these RPV problems. The topics to be embraced should include sensors, communication, command and control, data processing data display, navigation, counter measures and counter counter measures, launch, enroute and recovery guidance, flight control techniques, weapons delivery, survivability and vulnerability to provide papers for a symposium which should be of considerable interest to the designers and operators.

3. THE PURPOSE AND SCOPE

The purpose of this meeting was to bring together the principal disciplines involved in avionics and guidance and control design for RVPs. The sessions were structured around the logical and traditional design process, beginning with operational and concept requirements and terminating with integrated design concepts. Discussions were held after all the papers for the particular sessions were presented. It was hoped that in this way discussions would not be eliminated by the short periods available after each paper, nor to the details of one paper. These discussions quite well identified some of the critical issues and did open up some controversial areas. However, time was insufficient to deal with all these controversial areas in detail. In addition, there were considerable discussions after the meetings and during the various breaks between the various authors and observers involved in the meeting which were found to be extremely beneficial. In addition there are, however, traditional discussions in this area that have been published and argued for years. This evaluation will discuss the conference from the viewpoints of views on operational issues and requirements, state-of-the-art assessment of technology, identification of pacing technology or critical needs for R & D, major challenges and trends, systems integration concepts and issues and problems or unresolved areas of concern, provide an assessment of the technical material presented, and formulate recommendations for future actions.

4. SYMPOSIUM PROGRAM

The program of the symposium was arranged in 9 specific sessions:

Session 1 *RPV Operational Concepts and Requirements* included papers on concepts for utilization of RPVs large and mini, system requirements and technical operation constraints, airframe requirements and constraints.

Session 2 *Electro Optic Sensors for RPVs* which included passive electro optic sensor systems, active electro optic sensor systems, components and techniques for electro optic sensors, propagation and weather effects on electro optic sensors, data processing and display, and counter measures for electro optic sensor systems.

Sensor 3 *Radar and Radiometry Sensors for RPVs* including radiometric sensors, radar systems, components and techniques for radar and radiometric sensors; signal processing techniques including fixed target enhancement mapping; data processing techniques which include: target classification, bandwidth reduction, motion correction, data management and display; counter measure techniques; propagation, clutter, and associated weather effects.

Session 4 *Communications* which includes data links, relays, counter measures and counter counter measures.

Session 5 *RPV Guidance and Flight Control Techniques* which covers all aspects of flight control and guidance of RPVs, including the human operator aspects in the flight control loops.

Session 6 *Target Acquisition and Weapon Delivery* and their impact and interaction with guidance and control.

Session 7 *Command and Control*, including the challenge of tactical RPV command and control and modular command and control systems for RPVs.

Session 8 *Launch Guidance and Recovery Guidance For RPVs* which includes airborne launch for mini and maxi RPVs, autoland development and tests and shipboard launch and recovery.

Session 9 *Integrated RPV Systems* which includes description of integrated system discussing design trade-offs and cost benefits with emphasis on techniques to reduce cost, size and weight of the guidance and control and avionics systems.

5. TECHNICAL EVALUATION

Because of the scope and duration of the symposium and the fact that it was classified and no notes could be taken during the presentation it is extremely difficult for one person to assess and address all the issues and concerns which were discussed. In an attempt to aid the evaluator in gathering the necessary data and provide a consensus of the conferees a comments or reviewers' form was developed which is attached as Appendix 2 of this report. This approach was quite successful and provided many of the comments, observations, and assessments in the various technical areas of this report.

The keynote address was delivered by Dr. W.B.Laberge, Assistant Secretary General for Defense Support of NATO. This address outlined a potential need for RPVs in the NATO environment, but moreover stressed the urgent need for cooperative efforts among the nations to achieve this capability by sharing developments thereby reducing costs and insuring that these systems would be compatible with the NATO defense requirements. This address was very well accepted by the participants, which was quite evident in later discussions that ensued throughout the meeting.

Session 1 covered primarily operational concepts and requirements with the papers presented by military leaders or representatives from the various NATO countries. The requirements discussions were largely conceptual or philosophical and in most cases not well defined with the result there was a consensus and general feeling that at the moment there appears to be no firm, well identified requirement for RPVs, and hence there are considerable variations among the countries on what technical approaches in total system design should be undertaken. The lack of these requirements is probably understandable because of these large number of constraints and conditions that are being directed or self imposed. Some of these being considerable cost restraints on RPVs which dictate use of off-the-shelf-equipment. Secondly, the lack of any analysis, and evaluation of how RPVs will fit within the force structure, and thirdly, concerns for availability of sensors that are low cost but still effective under night and low visibility weather conditions.

Session 2 dealt primarily with electro-optical sensors. Three papers discussed the results of experimental testing of various types of sensors including infra-red, thermal imagery, and a unique sight strip display system. The remainder of the papers covered a review and analysis of sensor requirements for medium range surveillance and target acquisition systems. The predominant concern with the electro-optical sensors is their adverse weather capability limitations and high relative costs.

Session 3 on radar and radiometric sensors reviewed two papers on radar developments and associated experimental test results. The remaining papers reviewed results of development activity on Mini RPVs radars and a 3.2 millimetre surveillance radar. The primary concern expressed in the discussions centered on the testing of State-of-the-Art aircraft radar techniques for RPVs without any definition of the radar requirements for RPVs or innovative radar developments that will be suitable for RPVs.

Session 4 on communications reviewed one concept paper on communication and navigation for RPVs which set the stage for the remaining two papers. The first reviewed design communications system interactions which identified the problems associated with communications systems interaction. One paper discussed a new and innovative approach of a GaAs laser as a medium for data link application to provide an immune environment against ECM. The final paper dealt with the protection of video data links against ECM. The primary thrust of the papers presented in this session was the examination of techniques other than electro-magnetic for secure data link transmission. Very limited discussion ensued from these papers for several reasons, one being the experimental nature of some of the video data techniques and secondly the concern for environmental conditions predominately weather that could adversely affect video data transmission.

Session 5 on guidance and flight control techniques provided the most lively discussion of all the sessions. The wide range of technologies as the title would imply ranging from the guidance and control system for the multimission RPV that are already in the test phases and requirements for the navigation of sea based RPVs. The most interesting discussion centered around the use of strap down inertial systems in RPVs as a mechanism for integrating several of the guidance and control functions and thereby reduce the cost and weight of the systems, and a unique paper on terrain following design considerations for Remotely Piloted Vehicles. These two papers stimulated the majority of the discussions because of the potentials of integrating the specific technologies involved. In addition one paper was presented on a unique RPV helicopter design, and finally, one on human factor considerations in RPV operations. The consensus of this session was that basic technologies for RPV guidance and control techniques do exist and the knowledge for their implementation is available. However, the area of major concern was the extremely limited activity on integration of the functions so that cost-effective and light weight systems can be developed and fully implemented.

Session 6: Target acquisition and weapon delivery. This session had excellent papers on target acquisition and weapon delivery. Two of these papers were based upon the methodology and data base work from AGARD AASC Study group number 5 on the application of night vision devices to target acquisition and weapon delivery which provided the base line for the excellent discussion on the limitations and capabilities of these devices and the constraints involved in their application. The third paper on the optimization of television fields of view and other human factor studies in RPVs was also an excellent paper which discussed again the limitations associated with the problem of fields of view and resolution for target acquisition. The flight test and analysis of accurate munition delivery using a cannon launch semi active laser seeker guided projectile in conjunction with a laser designating RPV was a unique paper and a departure from the other techniques presented. The final presentation was a film which showed test results of target acquisition, identification and laser designation with Remotely Piloted Vehicles. This session was generally well received and stimulated a considerable amount of discussion. Again, the concerns centered around the fact that the majority of these techniques were addressing the favorable weather conditions with very little consideration given to low visibility tactical weather conditions. Also this work centered on adaptations of techniques that have been used in manned aircraft with minimum consideration on integration to reduce cost and complexity.

Section 7 on command and control had only three papers presented which tends to illustrate the infancy of the command and control technology for RPVs. One paper was a challenge for the tactical RPV command and control which outlined the problems and issues involved in RPVs, with the second paper providing a discussion on a modular command and control system for RPV ground stations. The final paper involved a concept of effective command and control for mixed force multiple RPV tactical operations which, though interesting and innovative, again illustrated some principle concerns with RPV command and control.

Session 8: Launch and recovery. Only two papers were available for this session. One covered the airborne launch of mini and maxi RPVs and the second a specific auto-land development and flight test effort. Results of these papers were well received and proved the technical feasibility of launching and recovering RPVs. The primary concern is the amount of ground or airborne equipment required to support RPVs, in general, and the fact that the cost of launch and recovery may be one of the limiting factors in RPV system development. Considerable interest was expressed in the area of mini RPV shipboard launch and recovery; however, a paper on that subject was cancelled.

Session 9: Integrated Systems. This session included a total of 5 papers spanning the area of Mini RPV System Design trade-offs through the application of a Mini RPV System to the middle European environment, and a film showing integrated RPV systems. Considerable discussion ensued from several of these papers. However, as reported earlier in this discussion, considerable concerns were expressed that very little if any innovative work had been performed on functional integration in RPVs to capitalize on multi sensor capability, digital processors, and other techniques known to be available, and that most of the work was performed using off-the-shelf manned aircraft technology as opposed to new and innovative techniques.

6. CONCLUSIONS

One of the most difficult aspects in establishing a set of conclusions is to base these conclusions solely on the results of the conference. In a conference of this type with a large number of disciplines represented it is difficult to maintain the necessary objectivity. The following conclusions represent the best summation possible by the author, but may not necessarily contain an awareness of other issues that may or may not be gleaned from the conference proceedings themselves.

6.1 The lack of specific requirements appears to be the one area that impedes development of RPV Systems. Without this requirement it is difficult to focus and structure a system to fulfill a need and stimulate innovative concepts. There is a thought that even perhaps a multirole RPV using active control technology could provide mission flexibility at lower cost than present designs.

6.2 An innovative approach to launch and recovery may be one of the keys to development of the RPV system. At the present these operational and support costs appear to deter or limit RPVs to highly specialized missions.

6.3 A new and innovative approach to functional integration to make maximum usage of on-board sensors is the key element to a cost effective development of RPVs.

6.4 The role of the human operator is not well known, and is still the subject of considerable discussion although data to date indicate that his role is probably most useful in a monitor and guidance role rather than a vehicle control role for several reasons, one being the data link band width requirements and secondly the work load imposed on ground based operator.

6.5 The area of command and control and secure data link seem the most ill defined areas of RPV control. These concepts directly impact force structure and mixed force considerations.

6.6 The lack of low visibility target identification and acquisition sensing capability appear dominant in determining system requirements and applications.

7. RECOMMENDATIONS

It appears that a NATO or AGARD or possibly an AGARD support of a NATO study group to determine critical technology areas of RPVs and potential designs that will permit these systems to be integrated effectively into force structure in a NATO environment should be formed.

Integrated control techniques that are currently being investigated for advanced manned aircraft should be investigated to determine if, through the application of techniques such as active control technology and functional integration there could result in a multi-role RPV system that could overcome some of the cost and design limitations exposed in this conference.

A study be performed to determine if alternate techniques, other than emulation of visual (i.e., FLIR, LLTV, etc.) can be developed to provide a low visibility operational capability. Precision positioning in a grid network with target state estimation may be a candidate.

ANNEX

GENERAL COMMENTS

1. SELECTION OF PAPERS

Over 100 abstracts were received in response that called for papers. Some of which were received too late for consideration at the meeting of the program committee. A committee had a difficult task in selecting approximately 50 papers which was considered to be the optimal number for a 5 day symposium, and was obliged to reject a large number of the abstracts submitted. The objectives were to provide a selection of high quality papers for each of the sessions that would fit well within the theme of the meeting and give a good impression of the range of interest and quality of work in the countries participating. In a few cases it was found possible to combine a small number of individual proposals in to a joint paper. The distribution of papers per country is shown below:

France	4
Germany	9 (also a narrated film)
UK	10
US	24 (also a narrated film)

Attendance: The total number of participants was 260 including 30 panel members. The National distribution was:

Belgium	Canada	France	Germany	Italy	Netherlands
5	5	27	57	26	6

Norway	UK	US	NATO Organizations
3	60	60	7

2. LOCAL ARRANGEMENTS:

The symposium was held in the SCUOLA DI GUERRA AEREA (Italian Air Force Warfare College) by permission of Generale S.A.Ezio Monti, Commanding Officer. The facilities were excellent and the Italian National Coordinator (Lt.Col. A.A.r.s. Dott. Felice Vagnarelli) is to be congratulated on the thoroughness and success of the arrangements. Generale S.Caggiani, Italian National Delegate, presented the opening address. Participants of the symposium were entertained at an official reception in the SCUOLA DI GUERRA AEREA hosted by the Italian Air Force.

APPENDIX I

FINAL PROGRAM

AVP/GCP Joint Symposium
AVIONICS/GUIDANCE AND CONTROL FOR RPV's
Florence, Italy, 4–8 October 1976

Opening Ceremonies. Welcome Address by Generale S.A.Ezio Monti, Commanding Officer of the Italian Air Force Warfare College.

Opening Address by Ten.Generale. Isp. S.Caggiani, Italian National Delegate to AGARD.

Keynote Address: Dr. W.B.LaBerge, Assistance Secretary General for Defence Support, NATO.

SESSION 1 – OPERATIONAL CONCEPTS AND REQUIREMENTS

Chairman: Mr. J.Freedman, US

- Utilization Concepts and Requirements – H.J.Weiss, Ministry of Defence, Germany;
- Royal Air Force and Royal Navy Future Concepts and Requirements of Unmanned Aircraft by Group Captain D.Allison, RAF;
- The British Army Requirement and Concepts of Use for RPVs by Col. A.W.McKinnon, Ministry of Defence, UK;
- Concepts and Requirements for Remotely Piloted Vehicles in the United States Air Force – Maj. Gen. T.I.Ahern, Headquarters, USAF;
- Concepts for Use of RPV's by the US Army – Brig. Gen. G.Dickinson, US Army;
- United States Navy Utilization Concepts and Requirements for RPV – Rear Adm. R.C.Mandeville, US Navy;
- Vulnerabilité des Drones ou "RPV" de Reconnaissance aux tirs des matériels anti-aériens - Lt. Col. R.Mure, Centre Interarmées de Recherche Opérationnelle, France.

SESSION 2 – ELECTRO-OPTICAL SENSORS

Chairman: Mr. T.J.Sueta, US

- Electro-Optical Sensors for Remotely Piloted Vehicles – K.Stich, US Army Night Vision Laboratory;
- Sensor Requirements for a Medium Range Unmanned Surveillance and Target Acquisition System (MRUASTAS) – F.A.Holmes, RARDE, UK;
- Analyseurs monolignes INFRA ROUGE de faible volume Cyclope et Super-Cyclope, et moyens de restitution associés – A.Chabonat and J.P.Cohen, Sté Anonyme de Télécommunications, France;
- Pyroelectric TV Cameras: The Potential for Thermal Imaging in Light-Weight Low Cost Systems – R.Watton, RSRE, UK;
- Sight-Stripes Accumulating Display – V.Doring and D.Dey, VFW-Fokker, Germany;
- Senseurs IR pour RPV de Reconnaissance – C.M.Pirolli and J.P.Fouilloy, T.R.T., France.

SESSION 3 – RADAR AND RADIOMETRIC SENSORS

Chairman: Mr. C.W.Cooper, UK

- HOWLS Radar Development – V.L.Lynn, MIT/Lincoln Laboratory, US;
- Microwave Radiometric Imagers for RPV Applications – R.P.Moore, Naval Weapons Center, US;
- 3.2 Millimeter Surveillance Radar for the US – R.H.Pearce and R.J.Wagner, US Army Electronics Command.

SESSION 4 – COMMUNICATIONS

Chairman: Dr. M.Vogel, Germany

- RPV Communications and Navigation – Col. H.M.Federhen, Advanced Research Projects Agency, US;
- RPV Design – Communication System Interactions – D.Gregory and J.D.Bannister, Hawker Siddeley Aviation Ltd., UK;

- The Protection of Video Data Links against ECM – B.J.Darby, J.D.Maines, J.B.G.Roberts, RSRE, UK and D.G. Stewart, Marconi-Elliot Avionic Systems Ltd;
- GaAs Laser for Data Link Application – Experimental Results – T.Gruhl, ESG Elektronik-System-GmbH, Germany.

SESSION 5 – GUIDANCE AND FLIGHT CONTROL TECHNIQUES

Chairman: Prof. C.T.Leondes, US

- The Guidance and Control System for the BGM-34C Multimission RPV – B.Rodgers, Lear Siegler Inc., US;
- Navigation for Sea Based RPV's – L.Newman, Naval Air Development Center, US;
- Radar Aided High Precision Navigation Systems for RPV – H.Winter, U.Brokof and K.Hurrass, DFVLR, Germany;
- Integration of RPV Navigation Guidance and Control Functions is Possible with Today's Strapped Down Inertial Systems – G.E.Martin, Litton Systems Inc., US;
- Control Aspects of the Plan-Symmetric Remotely Piloted Helicopter – A.J.Faulkner, Westland Helicopters Ltd, UK;
- Terrain Following Systems Design Considerations for Remotely Piloted Vehicles – D.A.Foster, Claspan Corp., US;
- Contrôle d'attitude d'avion sans pilote par sonde radioactive – J.-L.Boulay and S.Larigaldie, ONERA, France;
- Human Factor Considerations in RPV Operation – J.W.Lyons and M.D.Lister, Hawker Siddeley Aviation Ltd., UK;
- TV Operator Efficiency in Real Time Air-to-Ground Reconnaissance Missions – A.Güdesen, IITB, Germany.

SESSION 6 – TARGET ACQUISITION AND WEAPON DELIVERY

Chairman: Dr. W.Metzdorff, Germany

- Theory, Methodology and Data Base for the AGARD AASC Study Group No.5 Phase 2: Study on the Application of Night Vision Devices on Target Acquisition and Weapon Delivery – L.M.Biberman, Institute for Defense Analyses, US;
- Some Operational Implications of the AGARD AASC No.5, Phase 2 Study on the Application of Night Vision Devices to Target Acquisition and Weapon Aiming – M.H.A.Deiler and P.Manville, RAE, UK;
- The Optimization of the Television System Field of View for a Strike RPV and Other Human Factor Studies – J.N. Clare, S.A.Smyth and P.P.Seymour-Smith, BAC, UK;
- Flight Results and Analysis of Accurate Munitions Delivery Using Cannon Launch Guided Projectile with an RPV – H.L.Pastrick and R.A.Nulk, US Army;
- Target Acquisition, Identification and Laser Designation with Remotely Piloted Vehicles – A narrated film by S.H. Cochran and J.F.Class, Aeronutronic Ford Inc., US.

SESSION 7 – COMMAND AND CONTROL

Chairman: M. le Chef d'Escadrons H.Radet, France

- The Challenge of Tactical RPV Command and Control – Maj. G.C.Comfort, USAF/ASD;
- Modular Command and Control Systems for RPV Ground Stations – R.Koch, Dornier System GmbH, Germany;
- Effective Command and Control of Mixed-Force Multiple RPV Tactical Operations – D.G.Lewis and F.L.Goebel, Rockwell International Corp., US.

SESSION 8 – LAUNCH AND RECOVERY

Chairman: Mr. K.Perko, US

- Airborne Launch of Mini and Maxi RPV's – L.B.Stephens, Lockheed Aircraft Service Co., US;
- RPV Autoland Development and Flight Test – A.Smitchens, AF Flight Dynamics Laboratory, US.

SESSION 9 – INTEGRATED SYSTEMS

Chairman: Mr. C.Baron, UK

- Mini-RPV System Design Tradeoffs – K.Perko, Defense Advanced Research Projects Agency, US;
- Missions and Characteristics for Air Launched Reconnaissance/Early Warning Mini-RPV's – S.J.Colby and V.C. Tichenor, Lockheed Missiles and Space Co., US;
- Medium Range RPV Surveillance and Target Acquisition System – R.Chaplin, RAE, UK;
- A Technically Feasible RPV System Adapted to Middle European Environment – H.Schmidtlein and M.Mohring, VFW-Fokker, Germany;
- Film showing Integrated RPV Systems. Produced by G.Harms, Dornier GmbH, Germany.

CLOSING CEREMONIES

Following papers were not presented at the meeting due to lack of time and are included in the published Conference Proceedings.

(Session 5)

- Self-Contained Navigation for Remotely Piloted Vehicles – J.B.Lewi, Litton Systems, Inc, USA;
- Automatic Control of Drone Aircraft with DFCS – R.L.Howell, L.A.Gilson and T.D.Morris, IBM Corp., USA.

(Session 9)

- What is the Right Size for RPVs?

APPENDIX II

(EVALUATION FORM)

COMMENTS ON AGARD AVP/GCP SYMPOSIUM
Florence, Italy: 4–8 October 1976

TO ALL ATTENDEES

Considerable time and effort was expended by a number of countries in the organization and hosting of this symposium. As a result, the Program Chairmen are obligated to prepare an evaluation report. To aid them in preparing a timely, meaningful report; and since we have assembled here leading technical experts in the field; we solicit any feedback or comments you may desire to submit. These may be handwritten notes, and anonymous. If you have any questions, please contact the AGARD staff, the Program or Panel Chairmen.

The following are typical examples of areas in which observations, comments and assessments are desired:

(a) General observations

1. Quality, and relevance of papers, sessions and questions;
2. Did papers support the theme?
3. Did symposium live up to your expectations?

(b) Technical observations

Views on operational issues and requirements;
Assessment of technology (SoA);
Views on pacing technology or critical need for R & D;
Views on Role of the Human Operator;
What do you see as major challenges and trends?
Views on systems integration;
What area or problems are unresolved?

(c) Suggested improvements for symposium (procedures for enrolment, authors' instructions, logistics, etc.);

Please write your comments overleaf and hand them in to the Authors' Desk before the end of the symposium.

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14. Abstract

A joint symposium of the AGARD Avionics Panel and Guidance and Control Panel was held in Florence, Italy 4–8 October 1976.

Forty-five papers were presented on the following topics: Operational Concepts and Requirements, Electro-Optical Sensors, Radar and Radiometric Sensors, Communications, Guidance and Flight Control Techniques, Target Acquisition and Weapon Delivery, Command and Control.

This Technical Evaluation Report gives a brief review of the papers presented, the conclusions to be drawn from them and recommendations for further studies.

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